14. MONITORING AND ADAPTIVE MANAGEMENT

14.1. Introduction

In the development of the Salmon Recovery Plan (SRP) several key biological and political assumptions have been made. For example, land use and regulatory programs that are currently in place are assumed to continue without major changes. Harvest and hatchery regimes operating today were developed and being implemented under the assumption that commensurate habitat restoration actions were needed to sustain the targeted summer chum populations naturally after the hatchery programs are terminated. The harvest and hatchery programs are being implemented with knowledge that interaction with on-going and new habitat restoration and protection actions is required and that harvest regimes and hatchery production acting alone will not lead to ESU recovery. The harvest and hatchery regimes in progress today are expected to continue well into the future. The assumptions on which the SRP were developed are based on our current knowledge and understanding of salmon eceolgy. Only with its implementation over time, will we be able to gauge the correctness of those assumptions and adapt plan implementation activities to address changes. Human population growth and the accompanying development may exceed our current projections. Political changes may reshape existing regulatory programs. Environmental conditions may also change in ways that are unexpected.

SRP sections 1-13 provide the context for recovery of the Hood Canal/Eastern Strait of Juan de Fuca summer chum salmon ESU. They also provide the details of the actions that we believe are needed to recover summer chum. Section 15 spells out how this set of SRP actions can be implemented. This section, 14, describes the framework to:

- Evaluate the efficacy of the prescribed SRP actions addressing summer chum salmon habitat,
- Monitor the results and effects of those implemented actions, and
- Respond to those results by making changes to planned future actions.

Salmon recovery is an on-going process. Once the stated goals of recovery are reached, monitoring will need to continue to ensure that recovery is maintained and stable in the future. This monitoring and adaptive management requires a commitment for the future that translates to dedicated funding and/or staffing. Section 14 describes the types of monitoring that will be developed and pursued along with select, specific monitoring programs for all aspects of the SRP including habitat, harvest and hatcheries. A framework from which to develop the specific monitoring program is constructed in this section. As resources, forums, and mechanisms are identified during the implementation phases of the

SRP a more detailed monitoring and adaptive management program will be described.

14.2. Implementation Monitoring

Implementation monitoring is conducted to determine if a habitat action or suite of habitat actions was performed and/or completed as planned[58]. This type of monitoring will result in a yes or no answer, though lessons for adaptive management are also inherent in this category of monitoring. Within the context of salmon recovery planning, three functions fall under this category, including habitat actions, regulatory actions, and recovery plan progress. Table 14.1 provides a summary of the types of monitoring (beginning with implementation monitoring), funding needs and the next steps in the development of the monitoring program.

[58] Extensive monitoring and evaluation requirements and reports for harvest and hatchery actions have been implemented by the co-managers, and previously approved by NMFS under ESA 4(d) rule in 2002 and 2003. More details can be found in sections 4 and 5 of the SRP.

Table 14.1. Summary of SRP monitoring program items, funding needs and proposed next steps.

TYPE OF MONITORING	RECOMMENDED MONITORING	CURRENT FUNDING	PROJECTED FUNDING NEEDS	NEXT STEPS
Implementation • Were habitat actions implemented as designed? • Were regulatory program requirements met? • Is the recovery plan being implemented in a manner appropriate to reach milestones?	• Document implementation successes and failures and why, with LE and project sponsor producing one report per action. • Document regulatory program successes and failures and why, with periodic reporting. • Roll-up project reports to assess recovery plan implementation.	• SRFB currently funds project managers to perform this task, although only to meet contractual obligations. • County, state, and federal programs currently have compliance programs that would meet regulatory program needs. • WDFW currently funds LE coordinators to assess LE Strategy implementation.	• Limited funding needs for individual habitat action reports, although funds needed to develop templates for action types. • Consistent and comprehensive review of regulatory compliance would need improved enforcement and reporting mechanisms. • Fund reporting and adaptive management for recovery plan implementation.	• Develop standardized templates. • Develop coordinated approach to incorporate habitat actions by all funding sources (USFS, CREP, NRCS, etc.) • Discuss relevant programs and appropriate reporting and analysis mechanism • Continue to develop adaptive management framework to assess milestones.
Direct Effectiveness for Habitat • Did the habitat action(s) achieve the desired habitat condition? • Did the land use/management action(s) achieve the desired habitat condition?	• Adopt SRFB protocols and extend project monitoring beyond randomly selected samples to include all restoration actions by stakeholders. • Work with local jurisdictions to implement standardized monitoring protocols with individual actions such as stormwater facility installation.	• SRFB currently funds a subset of projects with TetraTech/Foster Wheeler contract, and allows project sponsors to apply for funds to monitor for maintenance of remaining projects. • It is currently unexplored as to how local jurisdictions monitor land use or management actions for habitat improvements relevant to salmon recovery.	• Fund remaining project monitoring. Monitoring costs could be assumed at 15% of project costs. • Fund development and implementation of protocols, QA/QC, data collection, analysis, and regional coordination for both habitat actions and land use/management actions.	• Work with project sponsors to fund and implement SRFB protocols on remaining habitat restoration actions. Also, work with Governor's Forum on Monitoring to continue to improve adaptive management through direct effectiveness mon'g. • Work with local jurisdictions to determine current efforts and future implementation approaches.

TYPE OF MONITORING	RECOMMENDED MONITORING	CURRENT FUNDING	PROJECTED FUNDING NEEDS	NEXT STEPS
Cumulative Effectiveness for ESA salmon • Abundance • Productivity • Spatial Diversity • Genetic Diversity	• Co-manager, USFWS, and volunteer spawner surveys and sampling in core and satellite watersheds. • Surveys of juvenile distribution and timing in estuary. • Documentation of spawner distribution. • Improved enumeration of out-migrant juveniles • Description of genetic and biological characteristics over time. • Estimation of hatchery straying. • Estimation of productivity (recruits per spawner). • Improved understanding of estuarine life history.	• Co-managers and USFWS fund survey and sampling staff in core watersheds while coordinating with volunteers for satellite populations • Co-managers fund rotary screw trap on Hama Hama River • WDFW and UW fund weir trap on Big Beef Creek • WDFW funds weir trap on Snow Creek • Co-managers analyze data and report results.	• Fund effort to improve survey coordination and GIS documentation. • Fund effort to assess efficacy of existing screw trap and opportunities for additional needs such as snorkeling or sonar. Depending on results, fund recommendations	• Improve survey coverage and GIS documentation. • Co-manager discussion on additional tools to assess productivity and estuarine juvenile surveys.
Cumulative Effectiveness for Habitat, or Habitat Trends • Did implementation of habitat actions and management plans achieve anticipated improvements in ambient habitat conditions?	• Implement long-term channel condition monitoring building upon existing geodatabase. Data is collected with TFW or modified-TFW protocols and extend back to 1992. • Implement nearshore monitoring of estuaries, drift cells, and submerged aquatic vegetation. • Implement watershed	• Complete coverage of summer chum basins (within the wadeable domain) were completed in the 1990s while HCSEG and HCCC have begun to re-inventory basins for habitat improvements. SRFB grant to HCCC developed early version of geodatabase. High resolution remote sensing done in	• Finalize geodatabase and queries. Develop QA/QC protocols for cooperating partners. Fund new surveys to determine trends in wadeable streams. Fund remote sensing and assessment for non-wadeable domain. • Develop and implement protocols for trend detection in estuaries and drift cells. Repeat	• Conduct regional discussions on status & trends monitoring programs' needs and existing capacities. • Implement gap analysis

TYPE OF MONITORING	RECOMMENDED MONITORING	CURRENT FUNDING	PROJECTED FUNDING NEEDS	NEXT STEPS
	trend detection program building on existing efforts for forest cover, type and age; total and effective impervious area; and freshwater and marine riparian quality and quantity. • Improve water quantity (peak flow, low flow, and flashiness) monitoring coverage • Long-term commitment to water quantity monitoring through conrtinuous funding of stream gauges • Coordinate and improve existing water quality monitoring coverage for parameters documented as limiting production for ESA salmon.	Dosewallips to establish baseline for non-wadeable. • Ecology conducted Shorezone Inventory, with hyperspectral imaging and historic vs. contemporary assessment of nearshore habitat complexes. • Several jurisdictions and programs utilize remote sensing for land cover and riparian conditions, although it is currently unknown as to repeatability and on-going commitments. • Flow gauging is well developed in the HCCC region for most ESA basins, though funds are sunsetting. • Several jurisdictions and programs do focus on random sampling for water quality, although few maintain long-term fixed or random sampling stations for trend detection. Water quality parameters are not well defined by reach or basin for salmon habitat limiting factors.	hyperspectral analysis of submerged aquatic vegetation given adequate funding. • Funding of the gap analysis • Needed funds unknown for watershed trend detection program until a gap analysis can be conducted. • Needed funds unknown for water quantity until a gap analysis can be conducted. • Needed funds unknown for water quality until parameters of concern are developed and a gap analysis can be conducted. • Funding of stream gauges	

TYPE OF MONITORING	RECOMMENDED MONITORING	CURRENT FUNDING	PROJECTED FUNDING NEEDS	NEXT STEPS
Validation • Is our understanding and assumptions of summer chum salmon life valid? • Did our habitat actions meet the cause and affect assumptions of improving salmon productivity in Intensively Monitored Watersheds?	• Track juveniles through the freshwater and marine systems to understand timing and habitat preferences • Verify that habitat restoration and enhancement can improve summer chum salmon productivity in Big Beef Creek.	• IMW program has been funded by SRFB and WA State to develop IMWs and monitoring regimes in those basins. Granting agencies has funded some habitat actions. HCCC and cooperating partners are currently querying watershed landowners for high benefit projects in the watershed.	• Additional funds will be needed to administer and manage the local portion of the program to work with landowners and implement habitat actions. Additional funds may be needed to continue programmatic monitoring by State agencies for next 12 years minimum.	• Work with partners and landowners to develop suites of habitat actions and submit to SRFB and other funding agencies.

The first key question is whether habitat actions and projects were implemented as designed to meet key salmon recovery issues. Documenting the reasons for project implementation success or failure is a component of adaptive management, and should be performed on all recovery actions. A standardized template should be developed and the appropriate parties should collaborate to produce a single report per action, for all current and future projects implemented within the ESU. The SRP proposes a standardized template be developed. It could determine if the implemented project met the intentions and objectives described in the salmon recovery plan, what lessons were learned, and what further steps are needed. Additionally, improved communication and coordination among SRFB and GSRO staff, HCCC staff, project sponsors, and project partners, will facilitate this effort.

The second question is whether programmatic actions, including land use regulations were implemented according to their intent. Documenting the reasons for the success or failure of programmatic actions is also an inherent component of adaptive management, and should be performed on a periodic basis. The HCCC is working on a matrix of actions committed to in the SRP and will use that to track progress on programmatic activities as well as projects. Specifically, with regard to land use and development regulations, the HCCC is working on a querying system of local jurisdictions' permit tracking systems. This querying system will help assess how development is progressing in relation to current land use regulations, which the SRP asserts are adequate to aid summer chum salmon recovery. This querying system is described more fully later in this section (14.6.)

The third question within implementation monitoring is whether the salmon recovery plan is being implemented as agreed by our various partners who made commitments within the plan. This question will also be addressed by our tracking of actions within our matrix. Reporting mechanisms will include coordinating individual reports, working with our various partners, HCCC reporting of programmatic actions through the use of our tracking matrix, and the reporting of trends at the ESU scale. All of these reporting actions will be developed on established timelines that meet the adaptive management framework and objectives of the SRP.

14.3. Direct Effectiveness Monitoring of Habitat Projects

Direct effectiveness monitoring tracks how well an implemented action or regulatory program met its objectives. An example of this is the SRFB's effectiveness monitoring program. Each project type (levee removal, large woody debris replacement, riparian plantings, etc.) has its own particular objectives and protocols that measure parameters of interest. This program samples a portion of the total number of projects implemented statewide. It uses random sampling to make statistical inference to projects statewide. Though

sampling is sufficient to say that any particular project type is effective, it is not sufficient to say that every project was directly effective at meeting its objectives.

Since each of the actions must be effective to recover salmon within the summer chum salmon ESU, the SRP recommends extending this project monitoring program to all projects except feasibility studies, using SRFB's protocols for each project type. The SRP also recommends that monitoring be implemented by the HCCC at the regional level and that it be coordinated with the SRFB effectiveness program managers and project sponsors to implement protocols under an established quality assurance progam (QAP). This coordinated regional monitoring effort should meet both sponsor requirements for maintenance monitoring and SRP requirements for effectiveness monitoring. This effort should also coordinate with other effectiveness programs, data management in conjunction with Washington State, local efforts, and should coordinate reporting. The HCCC will work collaboratively with the Governor's Forum on Monitoring to continue to refine an approach to adaptive management of projects through this program. Funding will be needed to extend effectiveness monitoring beyond the current SRFB sampling program, though opportunities may exist for leveraging local efforts.

14.4. Cumulative Effectiveness Monitoring of Salmon Recovery

Perhaps the most important parameter for monitoring the effectiveness of our actions towards the goal of salmon recovery is the species of concern itself. NMFS defines salmon recovery in terms of viable salmon population characteristics, including abundance, productivity, diversity, and capacity (McElhany et al 2000). For summer chum salmon, there is a strong program for enumerating abundance through fish escapement (spawning ground surveys) and harvest (fishing mortality.) Table 14.2 lists summer chum stocks by watershed and summarizes responsibility and methods.

Table 14.2. Summary of spawning ground survey programs necessary to evaluate performance and presence of each summer chum salmon throughout the ESU.

Type	Watershed	Organization	Method
Extant	Jimmycomelately	WDFW	Weir
Extant	Snow/Salmon	WDFW/NOSC	Weirs
Extant	Big Quilcene	USFWS/WDFW	Survey/Weir
Extant	Little Quilcene	WDFW	Survey
Extant	Dosewallips	WDFW	Survey
Extant	Duckabush	WDFW	Survey
Extant	Hama Hama	WDFW/HCSEG	Survey
Extant	Lilliwaup	LLTK/HCSEG	Weir/Survey
Extant	Union	HCSEG/WDFW	Weir/Survey
Reintroduced	Chimacum	NOSC	Survey
Reintroduced	Tahuya	HCSEG/WDFW	Survey
Reintroduced	Big Beef	WDFW/UW	Weir/Survey
Extinct/Extant?	Dungeness	DRMT	Survey
Extinct	Finch	WDFW	Weir
Extinct	Skokomish	Skokomish Tribe	Survey
Extinct	Dewatto	HCSEG	Survey
Extinct	Big Anderson	WDFW	Survey
Recently Observed	Fulton	HCCC	Survey
Recently Observed	Little Lilliwaup	Skokomish/HCCC	Survey
Recently Observed	Little Anderson	Stream Team/WDFW	Survey
Observed	Eagle	Skokomish Tribe	Survey
Observed	Stavis	Stream Team/WDFW	Survey
Potential	Tarboo	NW Watershed Inst.	Survey
Potential	Seabeck	Stream Team/WDFW	Survey

Table 14.2 describes each summer chum salmon stock as extant, re-introduced, or extinct. The table also notes whether summer chum have been observed (historically or recently). It should be noted that this list is derived, in part, from historic spawner observations in the WDFW spawner survey database and does not necessarily suggest historic occurrence of an independently stable population.[59] Table 14.2 also lists agencies, Tribes, and organizations that have had and will continue to have the primary responsibility for conducting summer chum salmon spawner surveys. Although these responsibilities may change over time as various programs evolve, implementation of the SRP by the HCCC

[59] Populations have been identified for recovery by WDFW and PNPTT (2000) and tentatively described by Currens (2004 draft in progress). These are described in SRP section 2.2.1 and 2.2.2. A table (Table 3.7) of populations/stocks being initially considered by the SRP can be found in SRP section 3.6.

and its salmon recovery partners will ensure that the populations of concerned are surveyed.

Productivity is another important parameter in measuring salmon recovery. It is a measurement of the number of adult salmon that are ultimately produced by each year's spawning escapement. Since the summer chum salmon from a given year's spawner population (brood year) return as 2, 3, 4, and 5-year old fish, it is necessary to have reliable age composition data for each annual return. The total return for each brood year is divided by the number of parent spawners to arrive at the brood year production rate, typically expressed as recruits per spawner (R/S). The Summer Chum Salmon Conservation Initiative (WDFW and PNPTT 2000) performance standards included a minimum value for mean natural-origin R/S rates that would contribute to stability and recovery of summer chum, and the SCSCI interim recovery goals included a natural-origin R/S threshold that would represent recovery. Increased scale and mark-recovery (otolith and adipose-clip) data collection in recent years have made it possible to distinguish between hatchery-origin and natural-origin spawners and recruits and to begin estimating productivity in terms of natural-origin recruits per spawner for a limited number of broods. Productivity estimates are presented in the Co-managers SCSCI 5-year review report (WDFW and PNPTT 2005 draft) for the Hood Canal summer chum ESU as a whole, for the Hood Canal and Strait of Juan de Fuca regions, for each management unit, and for each summer chum stock. GSI, sex, age and length data are being collected to assess trends over time.

"Diversity is reflected in the number of life history pathways of a population, in its biological characteristics and genetic traits, in the population's spatial distribution, and in the number and distribution of all populations across the landscape" (PNPTT and WDFW 2003b.) The Co-manager interim recovery goals include provisions to protect and increase summer chum population diversity (see Table 2.4 of the SRP). Monitoring for diversity must then be accomplished in several ways. As discussed above, spawner surveys across watersheds with summer chum categorized as extant, extinct, re-introduced, observed, and/or potential will be important in tracking changes in spatial diversity. Also, tracking distribution of spawners throughout a watershed will provide information relevant to summer chum diversity. For example, as the population of summer chum salmon has increased in Chimacum Creek due to supplementation and natural spawning, the upstream distribution of spawners has increased. GPS tracking of spawning locations would facilitate documentation and understanding of this aspect of diversity. Monitoring for changes in genetic diversity will also be important as populations evolve and potentially expand into satellite populations. WDFW has taken the lead on genetic analyses (WDFW and PNPTT 2003). Finally, documenting and understanding diversity of life history pathways in the marine nearshore environment is important in recovery planning. As populations increase in abundance and distribution, diversity of marine nearshore life

histories may also increase. Adjusting restoration and protection strategies to these various marine nearshore life history patterns is an important component of adaptive management.

The co-managers have developed productivity estimates (recruits/spawner) for the past five brood years of naturally spawning summer chum salmon populations. The estimates are based on analyses of escapement abundances, marked supplementation adult fish returns and age class data for both hatchery and natural origin adult returns to estimate brood year contributions. Recruit per spawner information can indicate how, where, and under what conditions habitat used by summer chum salmon may be affecting productivity. Deposited egg to emigrating fry survival information is still needed to focus productivity analyses specifically on freshwater habitat conditions.

14.5. Cumulative Effectiveness Monitoring of Actions and Ambient Monitoring of Habitat Conditions

Ambient habitat conditions should also be monitored to determine long-term trends in condition, a type of monitoring which is often referred to as status and trends. In the context of salmon recovery, did implementation of the entire array of both habitat actions and land use/management plans achieve anticipated improvements in ambient habitat conditions? Are our anticipated actions resulting in improving conditions across watersheds, or at least maintenance of existing conditions? Habitat listing factors from the Federal Register notice include summer chum watershed, floodplain, and channel conditions, riparian conditions, flow conditions, water quality, and marine nearshore/estuarine conditions (NOAA, March 10, 1998).

The HCCC and its salmon recovery partners have worked to develop a geodatabase[60] as a permanent repository and assessment tool for channel and riparian conditions (HCCC, in prep 2005). Data collected using Timber, Fish, and Wildlife (TFW) protocols from 1992 to present have been entered into a database, with stream segments assigned a latitude/longitude identification number. This approach allows for queries that produce results displayed on maps for any parameter of interest. Data include bankfull width and depth; canopy density; pool quality, quantity, and forming factors; habitat units; bank conditions; and woody debris surveys which measure size, position, function, type, and condition. All of the summer chum core population watersheds have had at least their mainstem covered, where wadeable conditions exist. Non-wadeable rivers such as the Dosewallips and Skokomish present conditions that are less readily described by TFW protocols and require a modified approach.

[60] "Geodatabase" is a spatially referenced database or a database that is organized according to the geographic area of concern. Such databases are commonly used in Geogrpahic Information Systems (GIS) applications.

One example of a modified TFW methodology that can be applied to non-wadeable streams by utilizing a combination of remote sensing and ground surveys was recently produced by the Port Gamble S'Klallam Tribe (Labbe et al, 2005). A similar methodology should be applied to the remaining non-wadeable streams to establish baseline data for trend detection and to provide data for design of habitat actions such as woody debris addition. The HCCC is currently examining how the geodatabase may be able to incorporate remote sensing data from these larger summer chum and chinook salmon watersheds.

The Washington State Comprehensive Monitoring Strategy and Governor's Forum on Monitoring recommended a status and trends monitoring program be implemented at the WRIA, salmon recovery region, and state scales to track freshwater habitat and water quality. This statewide monitoring framework is currently developing recommended protocols and a randomized sampling design. Though this approach is not the most comprehensive method for addressing status and trends of specific habitat listing factors for summer chum or chinook salmon as described in the Federal Register notice (NOAA, March 10, 1998), implementing some aspect of this approach could be an efficient complement to our existing watershed census. The HCCC will continue to work with Washington State to leverage monitoring partnerships such as this where appropriate. Future steps include determining an appropriate funding source for cumulative effectiveness monitoring.

The HCCC and its partners in salmon recovery are currently participating in a series of parallel habitat surveys being coordinated through the Pacific Northwest Aquatic Monitoring Partnership in the John Day watershed in Oregon. The objectives of these surveys are to compare commonly used habitat survey protocols across federal, state, and Tribal jurisdictions to determine the most descriptive, effective, and efficient protocols for use by the Partnership and will eventually be adopted by Washington State's Governor's Forum on Monitoring for use in the statewide monitoring framework.

Inherent in cumulative effectiveness monitoring and assessment is an understanding of watershed conditions that have led to changes in channel and riparian conditions. Forest age, type, and cover, road network and drainage intersection, as well as impervious areas and streamside development may all affect channel and riparian conditions. Many of these parameters have been quantified for each watershed and riparian corridor in county assessments, Salmon Refugia Studies, this SRP, and the US Forest Service, among others, though future efforts for trend detection and relation to in-channel habitat have not yet been established. The HCCC will continue to work with each jurisdiction to establish an appropriate adaptive management and monitoring plan using existing efforts where possible for remote sensing of watershed conditions.

Significant listing factors that will need long-term monitoring include water quantity and quality. Evidence suggests decreasing trends in certain summer chum watersheds, a fact that may be exacerbated by climate change. All summer chum watersheds except the Dosewallips River currently have flow gauges. State agencies, counties, PUDs, and non-governmental organizations should be supported in efforts to maintain these gauges, to make data accessible to interested parties, and to participate in future analysis with regards to summer chum salmon recovery and adaptive management of this resource. Additionally, we should coordinate and improve existing water quality monitoring coverage for parameters documented as limiting production for ESA salmon (temp., DO, turbidity, etc.). Most of these parameters are measured where problems are known to exist, but an additional randomized sampling framework and implementation strategy such as that being developed by Washington State currently would increase our coverage for monitoring these listing factors.

Another area of importance for cumulative effectiveness monitoring of habitat actions and programs is the marine nearshore. The U.S. Coastal Geodetic and Land Survey categorized and mapped certain physical conditions in the marine nearshore habitats of Hood Canal and the eastern Strait of Juan de Fuca during early European settlement in the late 1800s, documenting baseline habitat conditions to which we can make comparisons for trends detection today. The Point No Point Treaty Council has taken the lead in this effort by the inventorying of shoreline modifications (PNPTC, 2003) and documenting changes in estuarine and alongshore habitat complexes, with a specific focus on impacts to geomorphic processes (PNPTC, in prep 2005). These efforts have established both status and trends in physical shoreline conditions, and will be critical in determining the effectiveness of restoration, protection, and regulatory programs, when taken in conjunction with future remote sensing over decadal time periods.

Status, or baseline conditions of marine riparian and intertidal vegetation has been well documented, though trend detection in most parameters of interest is coarse and insufficient to address most local management questions and concerns. Projects such as the Washington State Department of Natural Resources' Shorezone Inventory documented percentage of overhanging vegetation and qualitative coverage of eelgrass meadows and kelp beds along marine shorelines of the state. Washington State Department of Ecology has documented shoreline conditions (including marine riparian) in the 1970's, 1990's, and 2000's with oblique aerial photos. Ecology also maintains a trend detection program for eelgrass beds throughout Hood Canal and Puget Sound using underwater photography. Although not determinative to date, there has been an effort to research functional linkages between shoreline development and the health of eelgrass beds in Hood Canal (as mapped using hyperspectral imagery), which could prove important as adaptive management of these critical juvenile salmon habitats moves forward in the future (PNPTC, 2002; PNPTC, In prep 2005).

14.6. Land Use, Development, and Regulatory Programs

14.6.1. Land Use Regulatory Monitoring Program

In previous sections, the SRP describes the harvest and hatchery programs that are in place that affect summer chum salmon. Those sections also describe the tracking systems that are associated with those harvest and hatchery programs. Also, in previous sections of the SRP, programmatic actions that affect summer chum salmon, including regulatory regimes, are described. This section addresses the need for an equivalent tracking system for those programmatic actions, particularly for the regulation of land use and development.

The development of a querying system for land use permits must have several characteristics to be useful for tracking impacts to summer chum salmon. It must be able to gather information from each jurisdiction that is at an equivalent level of detail and is comparable. It must be able to sum up that information and those trends at the ESU scale. It must also be able to assess significant departures from current land use regulations through variances, conditional uses and other waivers of those regulations.

Each local land use jurisdiction promulgates development regulations and issues permits under those regulations. Each of those jurisdictions also records and tracks those development permits with some sort of permit tracking system. However, those systems are all different from each other. The HCCC is currently assessing the magnitude of those differences and ways to overcome them. Also, there is no current system in place that can aggregate data and assess trends at the ESU scale. This is critical because the SRP analysis of regulatory programs concludes that current land use regulatory regimes are adequate to aid summer chum salmon recovery. But, this is the case only if those regimes are maintained. If significant relaxation of those current regulations takes place, then that assumption of adequacy may be undermined. To address this issue, the design and implementation of a land use and development permit querying system is needed.

The HCCC is working with each of our local jurisdictions, and other interested parties, to develop this permit querying system. That querying system will focus on permits and other development authorizations that might be detrimental to summer chum salmon habitat. HCCC staff, in conjunction with local governments' staffs and others, is inventorying the types of permits and procedures that are most likely to affect summer chum salmon habitat. The inventory will examine permits such as SEPA threshold determinations, building permits, variances, conditional use permits, conversions to non-forest use, floodplain development permits, shoreline conditional permits, shoreline permit variances, critical areas-related permits and other development authorizations.

The intent of this information system is to analyze trends and patterns of development and their consistency with current regulations. It is being designed with local government staffs to address information needs that they may have, as well as for salmon recovery purposes. This information will be provided back to the appropriate jurisdiction for their use in assessing their land use regulations and permit processing practices in an adaptive management fashion.

14.6.2. Impacts and Effectiveness of Regulatory Programs

Effectiveness monitoring of recovery actions has been described previously. Tools or models to evaluate programmatic actions, such as regulatory programs, are needed to assess the impact and effectiveness of regulatory programs and programmatic actions that are being considered by the Counties as part of this SRP (see section 13.3). The Ecosystem Diagnostic and Treatment (EDT) Method is a widely used tool to assist in the prioritization of habitat restoration and protection measures for salmon populations. EDT provides a systematic way of diagnosing habitat conditions that have contributed to the current state of fish populations. It enables an assessment of priorities for developing restoration and protection plans. It also provides an analytical procedure for assessing the potential benefits of actions that might be taken to address salmon habitat problems (Lestelle et al 2005). The SRP proposes to explore the further development of EDT as such a tool to address programmatic actions relative to summer chum salmon habitat and eventual recovery of the species.

14.7. Plan Integration and Adaptive Management

The SRP is intended to be an integrated plan. Each element in it contributes in concert with all of the other elements and on-going, related, summer chum salmon recovery processes. SCSCI section 3 describes the individual elements of habitat, harvest, artificial production, and ecological interactions[61] (WDFW and PNPTT 2000). The habitat element describes what conditions will allow the populations of summer chum to be productive. The harvest element reduces harvest impacts to very low levels that clearly will not impede recovery, and will be maintained at these levels that are consistent with the productivity of the populations. Given properly functioning habitat conditions, carefully controlled and extensively monitored artificial propagation programs can successfully supplement populations at moderate and high risk of extinction, and reintroduce naturally spawning populations where native summer chum stocks are extinct. The ecological interactions element is designed to further examine the complex

[61] Ecological interactions as described in the SCSCI are impacts on summer chum from other species, most notably other salmonids and marine mammals. Potential impacts from other salmonids include effects of hatchery operations, fish disease transfer, competition and predation. SRP section 2.3.2 also provides some details of ecological interactions.

relationships between summer chum salmon and other species, which share the same habitats. That element is also designed to reduce or control those interactions that may be limiting recovery (WDFW and PNPTT 2000). Together these four elements can provide the conditions necessary for the diverse set of summer chum salmon populations to recover. Integration of these elements can only occur as a result of assessing the outcomes of plan implementation and modifying the SRP through adaptive management approaches.

The SRP adopts the evaluation and review process as described in SCSCI section 3. The SRP will work with and augment the work of the co-managers as they develop annual reports (SCSCI section 3.6.2) and the five-year review report (SCSCI section 3.6.3). The HCCC will work with the co-managers by bringing to the evaluation and review processes the elements of habitat (programmatic and project actions) as addressed in the SRP. In particular, the review of the SRP will include the following steps (modified from WDFW and PNPTT 2000):

1. Review and describe performance of each element of the plan in meeting their specific compliance and effectiveness standards, as provided in previous sections of the SRP (and SCSCI sections 3.2 - 3.5), by management unit and stock, since the last review period and since adoption of the plan.

2. Evaluate management unit and stock performance relative to the standards provided in the SRP (and SCSCI section 3.6.4).

3. Determine which strategies and actions and conservation objectives were most effective and least effective and which management unit and stock did or did not see the desired improvement. Document the findings by management unit and stock and at the region-wide level, i.e., were successes concentrated geographically or were certain units chronically falling short of objectives.

4. Identify causes of successes and failures and categorize them according to type:

   - *Compliance/Implementation*: Actions were not implemented correctly or had a significant degree of noncompliance by user groups or governments.
   - *Effectiveness*: Actions were implemented correctly and had high degrees of compliance but did not have the intended effect(s).
   - *Assumptions*: Assessment methods or parameters were accurately or inaccurately estimated and applied.

5. Make adjustments to plan elements as provided in the SRP (and SCSCI sections 3.2 - 3.5). The HCCC and the co-managers will incorporate new

information from monitoring, evaluation and research studies in making adjustments as prescribed.

6. Make recommendations for plan changes or amendments. This information should be as specific as possible, including the watersheds, river systems, estuaries, management units, stocks, programs or projects, and fisheries affected, the type of suggested change and the time frame over which it should be implemented.

Results of these reviews will then be analyzed and become part of the discussion and dialogue in forums that will consider appropriate changes and adaptations to the on-going and prescribed recovery and management actions.